AGRICULTURAL Research

U.S. DEPARTMENT OF AGRICULTURE

JANUARY

1969

AGRICULTURAL
Research

January 1968/Vol. 16, No. 7

Comeback of Cotton

ARS is helping cotton hold its position in today's increasingly competitive markets—through a many faceted and continuing program of research.

For the cotton grower, this effort includes breeding new varieties of cotton, developing more efficient harvesting methods, finding better ways of controlling insects, weeds, and diseases, and working out more efficient ways to manage soil and water.

For ginners, ARS has developed several components for the gin mill of the future, including an unloading system that will help double the processing rate from 20 to 40 bales an hour (p. 7). Taken together, these engineering achievements will some day contribute to completely computerized ginning.

Some of the most exciting cotton research has come out of this agency's Southern utilization research laboratory, New Orleans, where scientists are developing new markets for cotton by extending its inherently good qualities. The laboratory's achievements include stretch and bulk cotton products, durable-press cottons and heat-, rot-, and weather-resistant finishes.

Southern laboratory scientists recently developed a way to add flame resistance to cotton batting (p. 6). About 2 years ago they improved cotton batting through the "Cotton Flote" process which greatly improved the cotton's resilience and thereby its comfort and durability.

These efforts have strengthened cotton batting's traditional but recently sagging markets in furniture upholstery, bedding, and the automotive field. Cotton batting began to lose favor as a padding material when foam rubber and polyurethane were introduced after World War II. Manufacturers used 100 million pounds of batting for furniture upholstery in 1951, but less than 60 million pounds in 1961. A similar decline had occurred in bedding and automotive manufacture.

Looking toward a brighter future, the potential market for fire-resistant batting is 750 million pounds a year. Last year, between 80 and 85 million pounds of treated batting were produced. This production is expected to rise to about 200 million pounds during 1969, as cotton begins to reclaim its former position in the upholstery market.

Editor: R. P. Kaniuka
Managing Editor: B. E. Scammon
Contributors to this issue:
R. C. Bjork, H. L. Brinson,
V. R. Bourdette, B. D. Carriere,
E. H. Davis, D. W. Goodman,
M. B. Heppner, J. L. Nordquist

AGRICULTURAL RESEARCH is published monthly by the Agricultural Research Service (ARS), United States Department of Agriculture, Washington, D.C. 20250. Printing has been approved by the Bureau of the Budget, June 1967. Yearly subscription rate is $1.50 in the United States and countries of the Postal Union, $2.00 in other countries. Single copies are 15 cents each. Subscription orders should be sent to Superintendent of Documents, Government Printing Office, Washington, D.C. 20402. Information in this periodical is public property and may be reprinted without permission. Mention of the source will be appreciated but is not required.

Orville L. Freeman, Secretary
U.S. Department of Agriculture

G. W. Irving, Jr., Administrator
Agricultural Research Service

New Technique:

Culling Ewes for Fertility

FERTILITY OF EWES can be determined faster and more accurately with a new technique that employs a simple operation and a portable surgery unit.

The new culling technique depends on the assembly-line theory that the number of units produced depends in the first place upon how many units are started down the line. ARS sheep physiologist C. V. Hulet wondered whether this theory could be applied to predicting a ewe's lambing potential. He thought he might be able to predict whether a ewe would have any lambs, single lambs, twins, or triplets by counting how many eggs she started into the reproductive system.

Eggs, which consist of a single cell, are nearly impossible to spot directly. The rate at which ewes produce them still can be checked. however, because a lump-like gland, the corpus luteum, grows on the ovaries at the spot where the egg was formed. Hulet found that ewes with one gland on the ovaries produced an average of only 1.3 lambs per year. But ewes with two glands averaged 1.6 lambs. and ewes with three glands, 1.8 lambs.

Studies by Hulet, who works at the U.S. Sheep Experiment Station, Dubois, Idaho, were initially hampered by the mechanics of checking ovulation. The process involved making a large incision in a ewe's abdomen and bringing the ovaries outside to count the lumps. This was traumatic for the ewe and tended to dry out and scar the ovaries. It also presented considerable danger of infection and tired out a surgeon who had to perform several examinations in succession.

Left: Assistant tilts sheep hammock in its frame. Right: Surgeon sits in chair with casters, moves from one surgery unit to another with ease. The examination can be performed routinely at the beginning of the breeding season on ewes of all ages (PN–1582, PN–1583).

Hulet and his coworkers designed an entire surgery unit for mass handling of sheep on the range. The unit consists of a canvas hammock that can be tilted inside its frame, much like a dentist's reclining chair.

An attendant places a sheep legs up on the canvas with the hammock set in the hortizontal position. He then slips a hook over each hind leg and secures them by tightening a selflocking leather strap. Next, he places the sheep's head on a headrest and slips the sheep's forelegs under nearby hooks. The sheep is ready for surgery only seconds after being lifted onto the hammock.

If necessary, the hammock can be tilted to a 60-degree angle with the sheep's head in a lowered position.

After injecting a local anesthetic, the surgeon makes a small incision just in front of the udder. To work through the tiny incision, Hulet designed a plastic funnel with the narrow end wide enough to hold an ovary. He inserts a small dentist's mirror through the funnel and rotates the ovary so that he can inspect all sides. A headlamp shines through the funnel to illuminate the ovary. Hulet says that the job is fairly simple, but that experience is required to count the appropriate glands.

The surgery is not dangerous, Hulet says, but the incision must be carefully sutured. In more than a thousand examinations, he has lost only one ewe as a result of surgery, apparently because of a bad suture.

None of the other ewes showed external signs of ill aftereffects. Fourteen ewes were operated upon three times in successive months without revealing any internal signs of harmful reactions to previous surgery.

Workers speed a flock through the examination by setting up three hammocks. Two assistants release the ewe just operated upon and place a new ewe on one hammock, while two other assistants prepare a ewe on the second hammock for surgery. Meanwhile, the surgeon examines the ewe on the third hammock. He sits on an office chair with caster legs. and moves from subject to subject without rising. An assistant surgeon follows and sutures the small incision. The team can handle 30 ewes an hour.■

Peripheral Circulation . . . New Home-Heating Concept

An experimental home-heating system that features constant-flowing curtains of air from baseboards to ceilings is an ARS agricultural engineer's attempt at better home heating.

ARS agricultural engineer J. O. Newman, at Beltsville, Md., is developing a system that effectively distributes and circulates only the desired amount of heat needed to keep the house cozy and comfortable. Called a peripheral circulation system, it might well become the most effective and economical home-heating system of the future.

Most of the problems associated with conventional forced-air and radiant systems can be traced to insufficient air movement and unequal air distribution. Newman's system forces air in a house to move in a definite flow pattern, eliminating hot and cold spots.

With systems that distribute heat by convection, there is no controlled air movement. Air near radiators is heated, then rises to create hot spots and stagnant air pockets near the ceiling. Moreover, radiators protrude into the rooms to mar their appearance and hamper furniture arrangement.

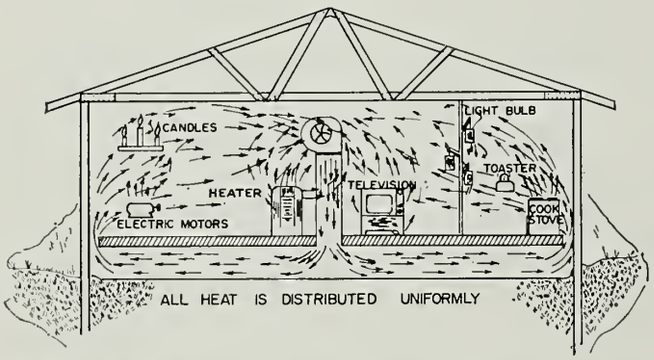
The system moves across a heat-producing source—from a conventional oil, gas, or electric furnace, or even a low-cost unit such as a pot-bellied stove or radiant heater—and throughout the entire house. Basically, here's how the system works:

The system utilizes a blower to pull air of varying temperatures—warm and cool—from all parts of the house into a central duct near the ceiling. Here the air is mixed to a uniform temperature, then forced through the duct down to the crawl space—called a low pressure plenum—under the house. Air escapes from the plenum along the baseboards and slowly enters the room then slowly moves vertically along the walls and horizontally back toward the blower (see illustration). The highest velocity air moves near the ceiling, where it does not disturb the occupants and where it prevents build-up of stagnant air.

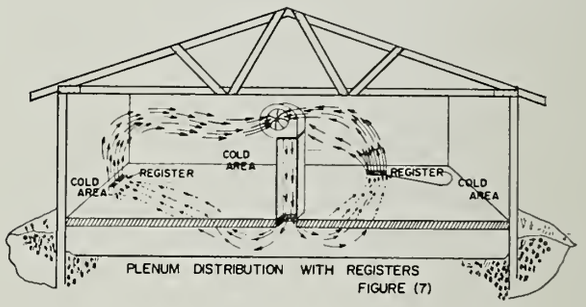
Since large volumes of air are distributed at low velocities, there is a minimum of drafts, a minimum of dust deposits and other problems associated with most forced-air systems. Because warm air enters the house along the baseboards, there are no radiators to hamper the arrangement of furniture.

Preliminary tests of the system on experimental 1-story houses show that temperatures can be maintained within 5° F. throughout the house and within 2° F. in individual rooms. Results also indicate that, for normal living conditions, a peripheral circulation system can be incorporated in a 1-story house during construction for $100 to $200. The system is especially suitable for houses with crawl spaces. It might also be possible to incorporate peripheral circulation as part of an existing central-heating system to improve circulation.

Newman says the system can be recommended for use now. He is continuing research toward refinement of components, applicability to multi-story homes, and homes with basements.■



Peripheral system. Gentle flow of evenly heated air from baseboards is virtually draft-free, eliminates drawbacks of present systems (PN–1584).

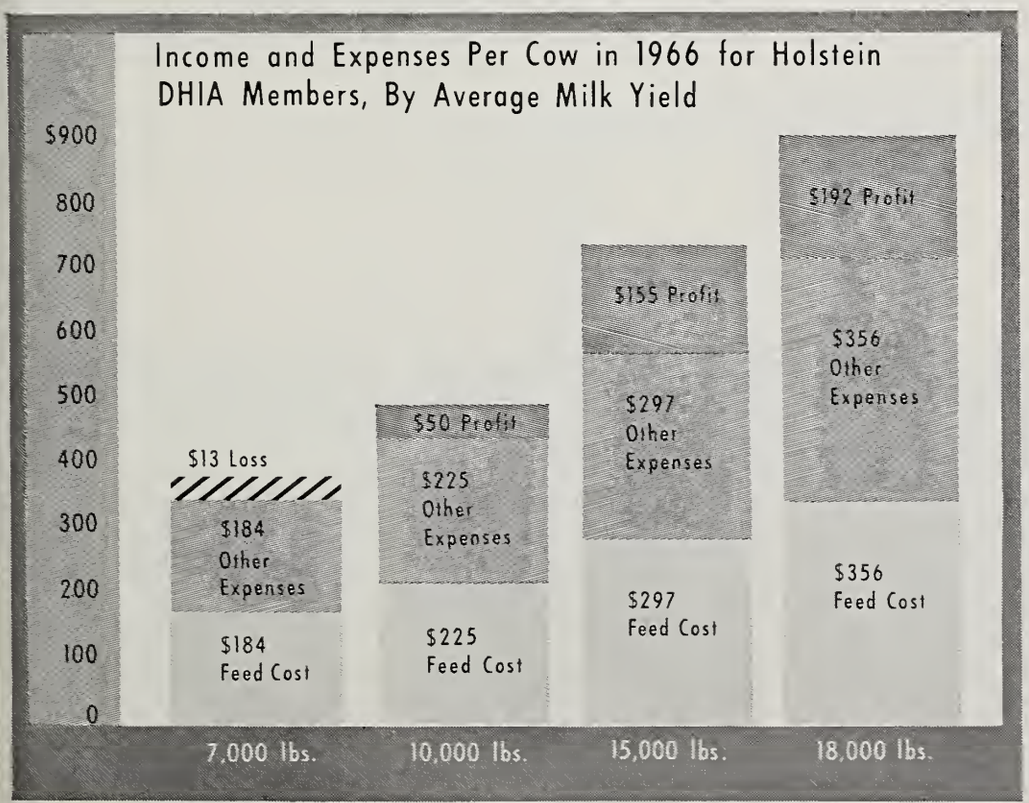


Conventional heating system. Rooms have uneven flow of air, drafts, and varying temperatures (PN–1585).

for MORE DAIRY PROFITS . . .

Improve Herd Before Expanding Stock

Holstein production records show that profits can range from a $13 loss when the average cow yields only 7,000 pounds of milk to $192 when she yields 18,000 pounds. DHIA officials say that overall good management generally makes the difference (PN–1586).



BEFORE A DAIRYMAN adds another cow to the herd, he should consider raising the production of the cows he already has.

Although this advice is not original, it is illustrated anew with computerized reports from the Dairy Herd Improvement Association. These figures are provided by 35,000 participants in the Standard Plan of recordkeeping, supervised by specialists of the Association who visit each member farm monthly.

ARS dairy breeding specialist R. H. Miller, who interprets data for the Association, says that the best illustration of higher profits from more productive cows can be taken from data on feed costs and gross income. Feed costs, Miller says, are roughly half the cost of production, so that income above feed costs provides an estimate of net income.

In Holstein herds averaging about 10,000 pounds of milk per cow, income above feed costs was $275 per cow in 1966; but in herds averaging about 15,000 pounds of milk, income above feed costs was $452—a $177 difference. The 10,000-pound herds used $2.24 worth of feed to produce 100 pounds of milk, but the 15,000-pound herds used only $1.99 worth of feed.

On a family farm, increasing production with the existing number of cows may be as good a way to improve income as materially expanding the herd size, Miller says.

For example, Holstein herds in the Standard Plan averaging about 18,000 pounds of milk per cow had a higher gross income than herds averaging about 10,000 pounds of milk, yet the more efficient herds had 8 fewer cows milking. The higher-producing herds grossed $37,335 from 41 cows, $12,785 more than the $24,550 grossed by the lower-producing herds which averaged 49 cows. The difference, Miller thinks, came about largely because of better management, breeding, and feeding.

One aspect of management that can be evaluated directly from the Association records for 1966 is the ability of farmers to keep cows in production consistently.

A group of more than 16,000 farmers participating in the Standard Plan reported that their cows were in production about 85 percent of the year and averaged 12,270 pounds of milk per cow. A group of 158 exceptional farmers, however, kept cows in production about 93 percent of the year, and averaged 13,118 pounds of milk. In contrast, 139 below-average farmers with cows in production about 70 percent of the year averaged only 7,992 pounds of milk.

Miller says that the farmers who achieved long milking periods and high production did so partly by devoting more time per cow because their herds were smaller. The herds with cows in milk 93 percent of the year averaged 37 cows; herds with cows in milk 85 percent of the year averaged 47 cows; herds with cows in milk 70 percent of the year averaged 59 cows.■

Flame Resistant Finish

. . . Developed for Cotton Batting

ARS UTILIZATION research scientists are now adding flame resistance as well as comfort and durability to cotton batting in their efforts to strengthen cotton batting's traditional position in the upholstery and bedding markets.

The experimental treatment involves the application of a ureaphosphate complex to cotton batting in addition to the chemicals used to make the new batting hold its shape and remain resilient through long use. All of the chemicals can be applied simultaneously by spray at the time the batting is made.

The research is being carried out at the ARS Southern utilization research laboratory, New Orleans, in cooperation with the Textile Waste Association, National Cottonseed Products Association, National Cotton Batting Institute, and the Foundation for Cotton Research and Education of the National Cotton Council of America. The research is being done by chemical engineer N. B. Knoepfler and coworkers, chemist P. A. Koenig and engineering technician W. T. Gentry, Jr.

In developing a durable flame resistant finish for cotton batting, the researchers were faced with the problem of keeping chemical costs low. As a result, they were forced to eliminate, because of their high cost, several chemical compounds that have proved very effective on fabrics.

For example, tetrakis (hydroxymethyl) phosphonium chloride is one of the best flame retardants for cotton fabrics, but its use would increase the cost of cotton batting by 25 percent. This would effectively eliminate economy as a major advantage of cotton batting over synthetic padding materials.

Knoepfler and his coworkers are quick to point out that all of the answers are not yet known. They know, for example, that using the less expensive chemicals results in a good flame resistant batting, but they do not know how long the finish will last. Limited testing indicates the finish is durable, but the tests have been going on for only 6 months. The researchers want to carry out these tests for a period of at least a year.

Cotton batting began to lose favor as a padding material when foam rubber and polyurethane foam were introduced after World War II. In 1951, for example, more than 100 million pounds of cotton batting went into upholstered furniture. By 1961 when furniture production was greater, less than 60 million pounds were used in upholstery.

Consumption also fell off dramatically in the automotive industry. In 1951, this industry used an average of 36.5 pounds of the old type of batting in each of the 6.7 million vehicles produced. By contrast, the average dropped to only 16 pounds per vehicle by 1961.

There are markets for as much as 750 million pounds of flame resistant cotton batting each year in the automotive, furniture, and bedding industries. The new improved batting introduced to industry recently by the ARS researchers is already being produced at an estimated rate of 80 to 85 million pounds per year.

The researchers believe that with the introduction of an effective flame resistant treatment that does not call for major changes in production and that can be applied at low cost, the production rate of the new batting may rise to about 200 million pounds per year by 1969, with good annual increases.■

Photos show what happened when treated and untreated cotton was exposed to flame for 12 seconds. Untreated sample continued to burn until consumed. Treated sample sustained only slight char (*PN–1587, PN–1588, PN–1589, PN–1590*).

New Cotton Unloader may DOUBLE Gin Processing Rates

THE DAYS WHEN workmen toiled and sweated over suction feed pipes that swooped up raw cotton from trailers at ginhouses may soon be over.

ARS agricultural engineer Oliver McCaskill, working at Stoneville, Miss., has developed an unloading system for gins whereby a trailer can dump its entire load into a receiving bin in one sweeping movement. The new unloading system is only one of many components that ARS engineers are planning for future gins in an effort to reduce costs and improve efficiency (AGR. RES., March 1966, p. 12). It promises to help double the processing rate of gins from 20 to 40 bales of cotton per hour.

Dramatic improvements in gins in the past 10 years have more than tripled their processing rate—from 6 to 20 bales of cotton per hour. This rapid increase in capacity is being made in an effort to lower the per-bale ginning costs, keep pace with the increasing number of mechanical harvesters in use, and get cotton out of the field and ginned with the least weather damage.

Some problems must be overcome before gins can fully cope with the vast demands placed upon them from increased mechanization of harvesting, at the same time, preserving the kind of fiber quality needed to make new finishes for cotton fabrics. Two bottlenecks of the conventional unloading system are its horsepower requirements and the physical inability of a man to manipulate the suction pipe at speeds sufficient to keep the gin supplied. The unloading system of a 20-bale-per-hour gin, for example, requires an average of 120 horsepower and three or four men to operate it.

The new unloading system reduces labor requirements 50 percent, cuts horsepower up to 95 percent, and assures an adequate supply of raw cotton to keep the gins humming.

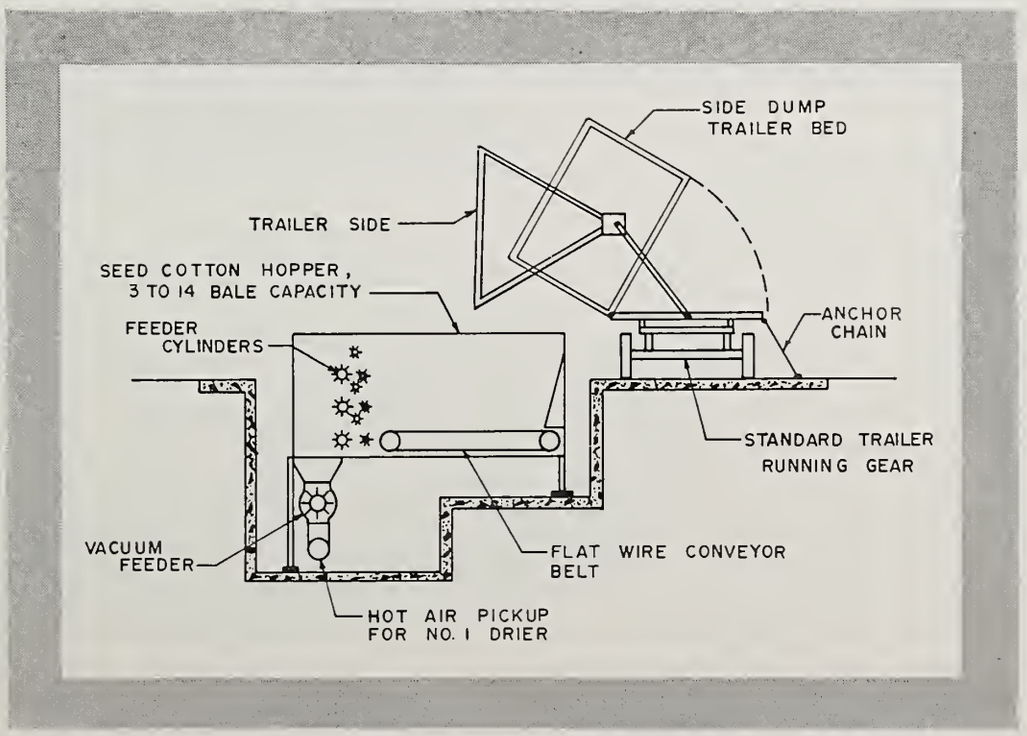
The new receiving bin can hold more than 14 bales of raw cotton at one time. It is equipped with a conveyor belt and feed rollers that convey the cotton from the receiving bin to hot-air pipes that whisk it to drying and cleaning machinery. From here, the cotton is automatically delivered to the gin stands, where the lint and seed are separated.

The conveyor belt and feed rollers are synchronized to automatically control the supply of raw cotton to the entire system at a uniform rate. A variable-speed motor powers the conveyor and feed rollers. Switches in the motor's circuit automatically speed or slow the feed rate to compensate for uneven bin loading.

Almost any type of trailer can be modified and used to dump cotton into the receiving bin. However, a trailer designed and built at Stoneville by ARS engineers is probably best suited for the job. The trailer dumps from the side; it has a lever arrangement that raises the side of the trailer clear of the cotton being dumped.

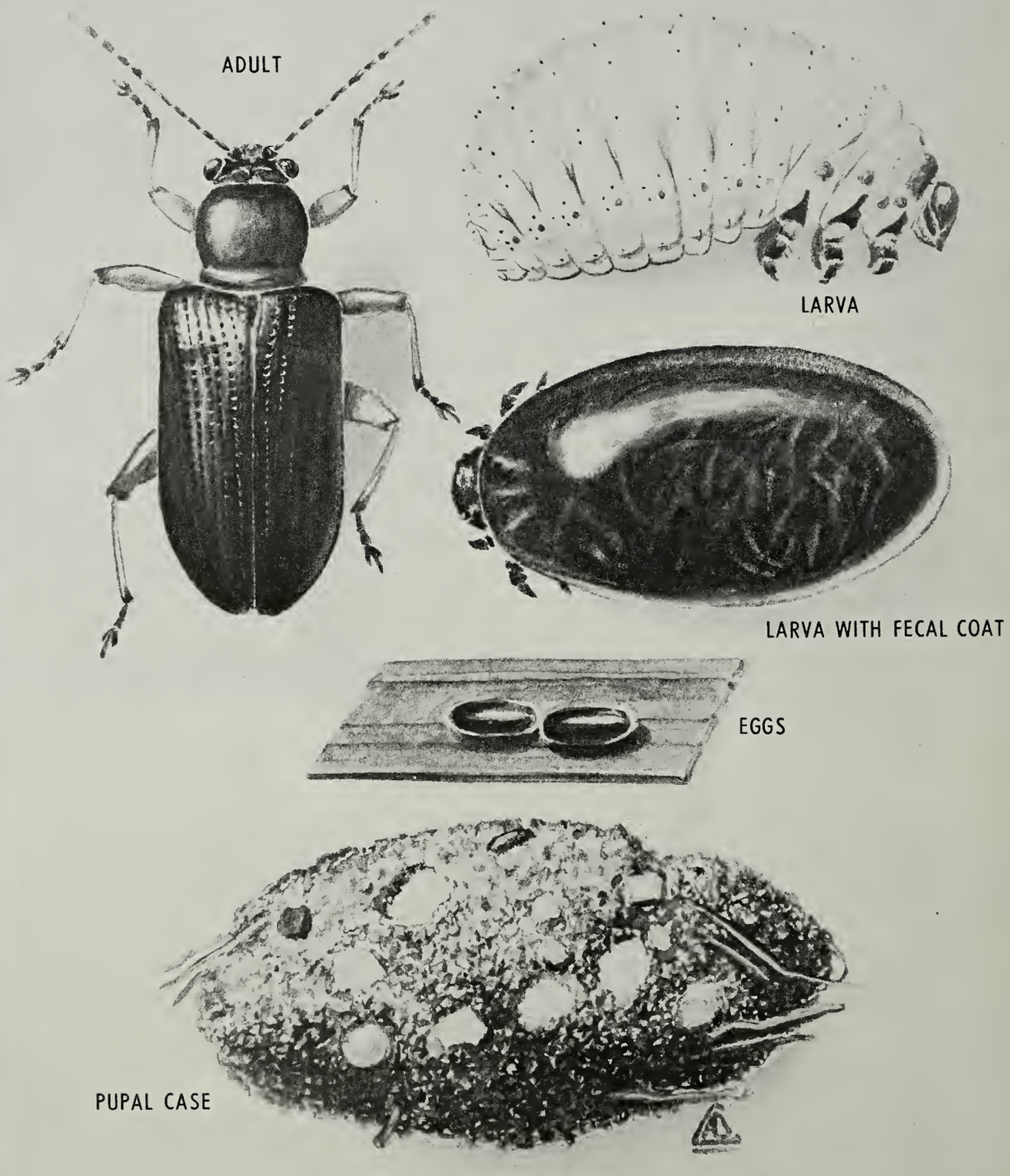
Components still on the designing board or being built are trash disposal systems, and cotton wrapping and packaging units. If all the experimental units prove as successful as the new unloading system, McCaskill predicts that total labor and horsepower now required to gin a bale of cotton will be cut 50 and 30 percent, respectively, and cotton fiber will retain more of its inherent quality.■

PN–1591



FIGHTING THE CER

BN-



AL LEAF BEETLE

ARS, STATE, AND FOREIGN agencies have combined forces to fight the cereal leaf beetle, a destructive pest of small grains.

The beetle, *Oulema melanopus*, one of the world's major destroyers of small grains, has become established in Indiana, Ohio, Michigan, and Pennsylvania and may thrive anywhere in the United States or Canada where susceptible crops are grown. It was first discovered in this country in 1962.

Each infested State has a quarantine requiring that hay, straw, fodder, litter, small grains, corn, sod, used harvesting machinery, and forage seed be treated and certified "pest free" before being moved outside infested areas. ARS plant pest control inspectors cooperate with the States in planning and maintaining these quarantines in the effort to keep the pest from spreading.

Another effort to prevent spread of the beetle—and to cut down the damage in infested fields—employs chemical insecticides. In addition to sprays applied by individual farmers, control is strengthened through a cooperative Federal-State control program. Low-volume aerial spraying of undiluted malathion at a rate of only 4 ounces per acre or carbarzl at 1 pound in 1 gallon of water per acre has been credited with significantly reducing cereal leaf beetle populations and retarding the spread of the pest. Spraying is timed to treat the beetles at the most vulnerable point in their lives—just before egg laying in the spring when they are still weak from the over-wintering period.

Still another control method is under study. At Niles, Mich., ARS has established a "parasite factory" to rear several species of parasites for release to prey on cereal leaf beetle eggs and larvae. (These parasites probably play an important role in controlling the beetle in Europe.) In cooperation with Purdue and Michigan State Universities, ARS is releasing these parasites in known infested areas of Indiana and Michigan.

The parasites being released were sent from Europe by ARS entomologists in France. Other cereal leaf beetle parasites and predators are being collected in Europe by ARS personnel and by foreign scientists awarded grants by USDA under Public Law 480. The hope is to find natural enemies that will control the beetle with or without reduced use of insecticides.

Research on rearing cereal leaf beetles in the laboratory to increase the production of parasites, is being conducted at Michigan State by ARS entomologists in cooperation with University scientists. These scientists are breaking diapause in the cereal leaf beetle with a hormone found by ARS scientists at Beltsville, Md. Diapause is the resting stage in insect life cycles. Breaking diapause eliminates the need for long periods of cold storage to simulate winter hibernation conditions in the laboratory. This makes possible the year-round production of beetles. Many more parasites can be raised each year.

In another Michigan study, scientists are trying to learn how pesticides affect parasites and predators that attack the beetle. They also are seeking insecticide applications which are least harmful to the pest's natural enemies, yet effective against the beetle.

The outstanding research development so far has been the discovery of resistance in some wheat varieties. This required testing of almost 40,000 varieties of wheat, oats, and barley. Plant breeders at several State Agricultural Experiment Stations are breeding resistant lines to the more popular wheat varieties in an attempt to develop a variety with a high level of resistance and acceptable agronomic characteristics.

No highly resistant oat or barley lines or varieties have yet been found. Plant breeders are trying to improve the moderate resistance of some lines by crossing semi-resistant lines to improve their value before crossing them with commercial varieties.

Research is also being carried out on just about every other known form of insect control, including insect sterilization by chemicals or radiation and use of attractants to lure pests to traps or insecticides. Scientists also are studying the beetle's biology, ecology, and behavior in its new environment. Among the most promising leads is the excellent protection of spring-seeded oats—despite high cereal leaf beetle populations—obtained through systemic insecticides applied to the seed before plantings. If use of these insecticides is approved, it would be a cheap and effective control on spring-seeded grains.■

ARS PROFILE

Seed germination, stem elongation, leaf expansion, flower production—all are controlled by light, and ARS plant physiologist Harry A. Borthwick has devoted his life to the study of this control.

His research has profoundly influenced scientific thinking in this field and opened the way for revolutionary developments in growing crops.

Borthwick was instrumental in the discovery and isolation from plants of the vital, light-sensitive pigment phytochrome, and later, of the part of phytochrome that acts as a switch in stopping and starting plant development. These discoveries have resulted in the formulation of basic principles now utilized in commercial production and in many areas of plant research.

A native of Minnesota, Borthwick received his doctorate from Stanford University, Stanford, Calif., in 1930 and joined USDA in 1936.

Borthwick, who retires Jan. 31, has headed ARS research on the influence of light in plants since 1948. He was appointed chief scientist when the ARS Plant Physiology Pioneering Research Laboratory at Beltsville, Md., was established in 1959. He is the author or coauthor of more than 130 scientific papers and, in 1961, was elected to the National Academy of Sciences.

Still a Pioneering Field. . .

PHYTOCHROME RESEARCH

BASIC STUDIES on plant physiology are contributing to efforts in tailoring plants that will suit specific needs.

ARS plant physiologists, for example, made substantial contributions when they discovered phytochrome, a light-sensitive pigment that changes form and directs certain plant growth processes in response to the kind and amount of light it receives.

Although studies by ARS and other scientists have revealed much information of practical value on how to use light to direct plant growth, phytochrome research is still a pioneering field with the lure of interesting, unanswered questions.

Recent studies of mimosa and henbane are examples of continuing research.

The mimosa folds its leaves in darkness. Phytochrome controls this response, which takes only 30 minutes compared to the 24 hours required for most other responses. The rapidity of this response rules out the theory advanced by some scientists that a dormant gene is activated by the proper conditions. Gene activation would require hours—to desuppress the gene, to synthesize proteins, and to enter these proteins into metabolic patterns that would cause the response. Gene activation is probably involved, however, in some phytochrome reactions.

At the same time, the scientists found that another mimosa response was aided by some factor above and beyond the typical phytochrome reaction. This factor was also discovered in concurrent studies of the henbane weed.

Mimosa leaflets opened in light despite the presence of the phytochrome form that closes leaflets after dark. It was obvious to the scientists that some other photoreaction was opposing the phytochrome action.

Unlike the phytochrome response, this second element, called a high-

energy response (HER), was not reversible and increased with more light instead of becoming saturated. The HER may also include more than one reaction.

Significantly, ARS plant physiologists H. A. Borthwick and S. B. Hendricks discovered that that part of the light which caused the HER opening of mimosa leaves was similar to that which caused other HERs including the flowering of henbane.

The interplay between phytochrome and the HER in the flowering of henbane is an important factor influencing the adequacy of fluorescent and incandescent light in plant growth experiments. A small amount of incandescent radiation added to fluorescent light markedly promotes flowering of some plants. The incandescent light may provide the varied radiation needed in the HER reaction.

The roles of light in growth and flowering are inadequately resolved. This is particularly true for the flowering of long-day plants (those that require long periods of light to bloom) such as henbane, spinach, beets, wheat, rye, and barley. Although findings on short-day plants have been used commercially, the more complicated long-day plants have required much more study.

When sugarbeet breeders, for example, who sometimes grow these long-day plants during the winter for seed production and extend the days with artificial light, switched from incandescent to the more economical fluorescent lighting, they ran into trouble. The plants grew, but did not flower, and so did not produce seed. The fluorescent lighting did not provide the quality of light needed to trigger the HER phytochrome reactions that cause flowering.■

T. F. Clark, of ARS's industrial crops laboratory, Peoria, Ill., stands in partially harvested field of tall-growing kenaf (PN–1592).

KENAF, GROWN IN many foreign countries as a textile fiber crop for manufacturing rope, twine, and cloth, looks promising as a new crop for papermaking in the United States.

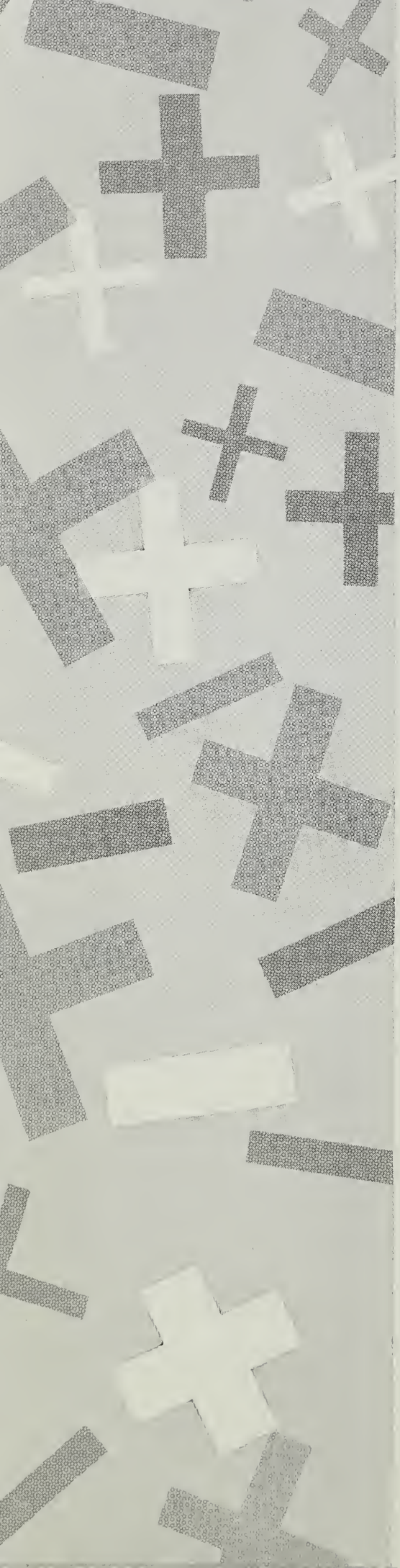
Kenaf is one of about 400 species of fibrous plants that scientists at ARS' Northern utilization research laboratory, Peoria, Ill., have evaluated as raw products for making paper products.

Raw material demands in the paper industry are rapidly increasing. Wood pulp which now constitutes more than 97 percent of all papermaking raw materials, is becoming more expensive. The other 3 percent comes from rags, bagasse, flax straw, manila stock, cotton linters, and kelp.

Kenaf provides certain advantages over wood. The annual fiber yield per acre of kenaf is usually two to three times that of wood, and it produces papers with properties and performance comparable to most softwoods and superior to most hardwoods. In addition, it is easier to pulp than wood and produces a more tight, nonporous paper. Kenaf can also be used as a blend to improve some lower quality pulps.

Kenaf adapts well to many U.S. growing regions, but in ARS tests, Florida-grown kenaf gave consistently higher pulp yields than Illinois-grown kenaf. The entire stalk is utilized as raw pulp material which permits mechanical harvesting and processing at minimum cost. Harvesting can be timed to best utilize available labor and equipment.

Kenaf may be harvested and pulped green during much of the year in relatively warm regions, or it may be harvested green or after it has been killed by frost and field-dried in more northern areas. Yields up to 10 tons or more of dry matter per acre per year have been obtained. In limited ARS tests, however, green kenaf gave slightly lower pulp yields than field-dried kenaf from the same region.■



Scientists find AIR IONS have no effect on ANIMAL GROWTH, HEALTH

SIX YEARS OF research have ruled out the possibility that certain types of negatively or positively charged air ions affect animal growth and health.

ARS and State scientists at Davis, California, suspected an influence other than heat, light, wind, rain and humidity, while working with hogs in the laboratory. They noticed that growth and feed conversion rate were consistently higher in laboratory tests than in field trials.

Earlier studies by medical researchers on controlling diseases with radiation, heat, and electricity suggested that excesses of certain types of ions in the air—negatively or positively charged particles such as dust, microorganisms, or gascous molecules—might influence growth and health.

The ARS researchers, in cooperation with the California Agricultural Experiment Station at Davis, initiated studies in 1960 to test effects of ion polarity on animal growth and production. Environments with a preponderance of either negative ions or positive ions were compared with one of natural ion distribution to determine the effects on growth rate and feed conversion efficiency in hogs, and growth, mortality, and sexual maturity rates in Japanese quail.

Seven tests with Duroc hogs show conflicting results. Three tests indicate that the ions did not affect weight gains; one indicates an excess of negative ions was harmful, another shows positive ions to be beneficial in one test and harmful in another in the other test. In still another test, weight gains were better with both positive and negative ions than in the natural environment.

Experiments with groups of 50 to 60 Japanese quail provided results that also varied widely among tests. In all but one of six trials with quail from 1 to 28 days old, body weights were less for the positive ion group than for the negative or natural ion groups. Ion treatments showed only minor and insignificant effects on mortality and sexual behavior.

The study was conducted by agricultural engineers T. E. Bond and R. L. Givens of ARS, and H. Heitman, Jr., F. C. Jacob, C. F. Kelly, C. M. Sprock, J. B. Dobie, and W. O. Wilson of the California station.■

Age old chore...

OLIVE HARVESTING is MECHANIZED -

THROUGH THE CENTURIES man has harvested olives by hand. Now, two agricultural engineers in California are developing equipment to mechanize the job.

R. B. Fridley of the University of California at Davis, and P. A. Adrian of ARS, are working on a high-powered, inertia-type shaker that attaches to the tree branches and shakes the fruit off by vibration. The falling fruit lands on a catching canopy under the tree.

Two principal types of shakers are used to harvest fruits: the boom type, which is rigidly fixed to its power source, such as a tractor, and the inertia type, a self-contained shaker connected to its power source by hydraulic lines.

The business end of the experimental shaker for olives is a hydraulic motor-driven crankshaft, which is capable of delivering three different shaking strokes. Other features of the shaker include a padded grip clamp, suspension arm, and push button-operated hydraulic controls.

Mounted on a forklift mast, the suspension arm is easily maneuvered and can be attached to branches in a nearly perpendicular position. The operator can completely control operation of the shaker from his seat on the rear of the unit with the push button controls.

The experimental shaker is capable of operating at vibrating frequencies of up to 2,000 cycles per minute at strokes of 2 to 4 inches. Total weight of the unit is 325 pounds. Temporarily, the researchers are using a flatbed truck to transport the unit through the orchard and to different parts of the State.

In 1966, Fridley and Adrian field-tested the shaker on Manzanillo, Sevillano, and Mission olives. Fruit removal ranged from 60 to 90 percent. Harvest yield on pruned trees was higher because fruit grew in better patterns and the operator could easily attach the clamp to branches.

The researchers will conduct further tests with the shaker. They will also work on ways to minimize injury that occurs when the fruit hits that already on the canopy.■

OLIVES HAVE been cultivated since antiquity in Asia Minor and Southern Europe. The Spaniards first brought them to California in 1769. Some of the original trees are still contributing their share to the annual olive crop. There are now some 27,000 acres of olive trees in the State, producing about 58,000 tons of fruit annually. Most of the fruit is prepared for eating; however, some of the crop goes into oil, soap, perfume, and medicine.

Cotton Plant Pruning: Is it practical?

DOES PRUNING HAVE any effect on boll set, boll rot, plant lodging, yields and maehine harvesting efficieney of rank eotton plants growing on highly productive soil?

ARS researehers in Mississippi are trying to find the answers to these questions by elipping 4 to 8 inehes off the tops of plants and 3 to 4 inches off the side branehes. This is done during the fruiting season, whieh lasts from July 15 to August 15 in the Midsouth. They use a high-clearance weed clipper for topping and a double-blade rotary cutter for side snipping.

After 5 years of tests, the scientists found:

- Topping decreased boll set the first week after treatment but significantly inereased boll set the seeond week after treatment. On side-clipped plants, peak boll set oeeurred the third week after treatment.
- Pruning had no apparent effeet on boll rot control or plant lodging; however, only minor boll rot and lodging problems occurred during the test.
- Pruning side branehes did not affect yield significantly. Topping alone, however, tended to inerease yields in two of five years, while topping eombined with pruning tended to decrease yields.
- Trash content of eotton samples from pruned plants was not signifieantly different from trash eontent of unpruned plants. Grades of eotton fiber tended to be lower from the unpruned plots; however, the difference was signifieant in only one year.
- Pruning did not appear to affeet machine harvesting efficiency. (The researchers say this may have occurred because there were no severe plant lodgings in the test.)

The continuing ARS tests are under the direction of agrieultural engineer E. B. Williamson, plant physiologist R. O. Thomas, plant pathologist C. D. Ranney, and cotton teehnologist C. S. Shaw. The study is conducted in cooperation with the Delta Braneh of the Mississippi Agricultural Experiment Station at Stoneville.■

Scientists Isolate, Identify Three Broadbean Disease Agents

SCIENTISTS ARE making headway against three diseases that lay waste up to 50 percent of the annual erop of broadbeans, a dietary staple in Europe and the Near East.

Working on a trial farm near the Persian Gulf, ARS scientists have tested 38 collections (strains) of broadbeans in the first stage of an attempt to develop Iranian varieties that are resistant to ehocolate spot, rust, and yellow mosaie. The broadbean (*Vicia faba*), is commonly called horsebean or bellbean.

Researchers with the AID-supported Regional Pulse Improvement project at Tehran, Iran, say that several of the tested collections at Dezful showed some degree of resistance to one or more of the three diseases. ARS researeh plant pathologist W. J. Kaiser says that after more work in the field and greenhouse, these eollections may become the nueleus for a breeding program to incorporate disease resistance into loeally grown broadbean varieties. The beans are used fresh and dried in several different dishes.

While testing the 38 eollections for resistance, Kaiser also isolated and identified the agents of the three diseases. The fungus *Botrytis* is the cause of chocolate spot, by far the most destructive of the three.

High humidity and frequent rains during the growing season make conditions ideal for ehocolate spot to reach epidemie proportions. Although in the past it has been observed in several other Middle Eastern eountries, the disease has only recently been reported from Iran. Choeolate spot has two distinet stages, "non-aggressive" and "aggressive." The aggressive stage attaeks leaves, stems, and pods, often killing the plant. The non-aggressive stage is mueh milder, producing small, reddish-brown lesions on the leaves.

Rust, also caused by a fungus, was mostly eonfined to the leaves, though on some very susceptible varieties it also infected the stems of the plants.

Yellow mosaic, caused by a virus, also infected broadbeans, and, like rust, the infeetion was mainly eonfined to the leaves, though a small number of green pods were infected. Both rust and yellow mosaie together, however, are not as damaging as the devastating ehoeolate spot.■

Herbicide Treated Cloth

Herbicide treated cloth may someday replace the weed sprayer around the home.

Developed at Beltsville, Md., by ARS plant physiologist L. L. Danielson (AGR. RES., May 1966, p. 13), herbicide treated cloth is now being tested by several companies for possible commercial sale.

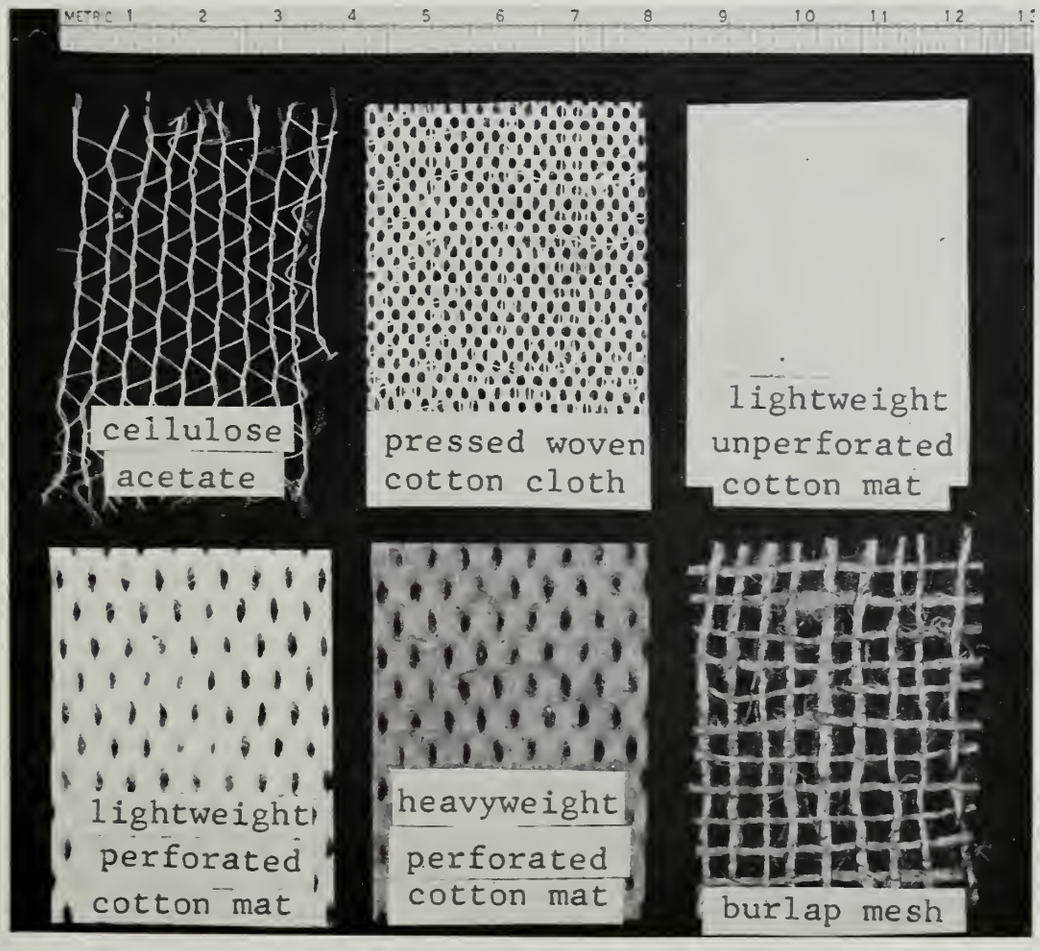
Herbicide treated cloth is a result of a program to develop new methods of applying herbicides to horticultural crops with accuracy, safety and effectiveness by the average person who lacks specialized training in the use of herbicides.

Simple for the homeowner to use, herbicide treated cloth could take the guesswork out of weed control and eliminate messy mixing. The user would simply buy the correct size to fit a flower bed, or cut pieces to fit small or irregular beds or even plant pots.

Danielson is testing various cloths, herbicides, and horticultural crops to determine which combinations give the best results.

Several kinds of cloth, including acetate, lightweight and heavyweight perforated cotton mat, lightweight unperforated cotton mat, pressed woven cotton cloth, and burlap mesh have all proved to be effective herbicide carriers.

Danielson found that the acetate cloth and pressed woven cotton cloth breaks down in soil more rapidly, within 30 days. Lightweight unperforated cotton mat is more resistant to breakdown; it disintegrates only slightly after 120 days. The other cotton mats and burlap are intermediate in rate of breakdown.



Six samples of cloths used in experiments (PN–1593).

"Outdoors USA": Handbook of Conservation

The opportunities that rural America offers for living, working, and relaxation are told in the 1967 Yearbook of Agriculture, "Outdoors USA."

This publication is a handbook of conservation and wise use of natural beauty.

It is of interest not only to citizens concerned about conservation of our natural resources, but to hunters and fishermen, family campers, children eager to learn about the outdoors, and farmers interested in profitmaking recreation enterprises.

In the foreword, Secretary Freeman noted that about half the Department's staff works in some phase of conservation to preserve natural resources, while getting the most use from them. These USDA'ers, he said, are helping to develop forests and wood sources; helping to develop watersheds and river basins, fish-stocked lakes, and ponds for swimming and boating as well as storing water; helping to develop farms that besides growing crops offer good hunting, fishing, and other recreation.

"Outdoors USA" contains 408 pages of text illustrated with over 220 black and white photographs, plus a section with 43 color photographs. There are 109 chapters under 4 headings: The Big Woods, Water, Beautification, and The Countryside.

Most of the authors are USDA specialists, but university faculty members, outdoor writers, and officials of other government agencies have also contributed chapters.

UNITED STATES GOVERNMENT PRINTING OFFICE
DIVISION OF PUBLIC DOCUMENTS, WASHINGTON, D.C. 20402

OFFICIAL BUSINESS

PENALTY FOR PRIVATE USE TO AVOID
PAYMENT OF POSTAGE, $300
(GPO)

AGRISEARCH NOTES

"Retired" to Smithsonian

A horse-drawn sprayer, thought to be the oldest USDA-owned agricultural machine, has been transferred to the Smithsonian Institution for display in the Museum of History and Technology in Washington, D.C.

What is certainly the oldest power sprayer owned by USDA, this machine was used to control gypsy moths in roadside and woodland foliage from 1908 to about 1915, when it was replaced by a truck mounted model.

The horse-drawn, solid steam powered model was built by the Fitzhenry-Guptill Co. of Cambridge, Mass. It is still in excellent condition, lacking only a team of horses to return it to service.

The sprayer somehow avoided the scrap pile after it was removed from service. For the past few years it has rested proudly alongside modern spray planes in one of the hangars at the Agricultural Research Center airport, Beltsville, Md.

Photo below: The larger photo was made when the sprayer was still in service along the wooded roads of the Agricultural Research Center. The operators, employees of the Department, pose proudly with their machine and equipment. The insert shows the machine spruced up and ready for display in the Smithsonian (TC–3270, PN–1594).

New Plastics from Pine Gum

New heat-resistant plastics from pine gum that may find use in products ranging from electric wire insulation to rocket nose cones have been developed by ARS scientists working at the Naval Stores Laboratory, Olustee, Fla.

Called polyimide-amides, the new plastics are made by reacting a chloride of maleopimaric acid—readily obtained from pine gum in good yields—with a series of diamines.

The experimental plastics performed well in the laboratory at temperatures up to 750° F. Chemists W. H. Schuller and R. V. Lawrence are hopeful of improving them so they will tolerate substantially higher temperatures.

Several different formulations of the new plastics are now under preliminary evaluation by industry where they could find widespread utility. In addition to wire insulation and rocket nose cones, the plastics may prove useful in the electronics, automotive, and other industries.

CAUTION: In using pesticides discussed in this publication, follow directions and heed precautions on pesticide labels. Be particularly careful where there is danger to wildlife or possible contamination of water supplies.

PROTECT
Use Pesticides Safely
FOLLOW THE LABEL

U.S. GOVERNMENT PRINTING OFFICE: 1968